RELAXATION AS A NURSING INTERVENTION IN THE MANAGEMENT OF HYPERTENSION

by

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CHAPTER I

INTRODUCTION

Essential hypertension is a chronic disease requiring long-term treatment. A major problem in the management of hypertension is the wide range of side effects from antihypertensive drugs. When an asymptomatic hypertensive person is treated with drugs that cause distressing symptoms, it is easy to understand the person's reluctance to comply with treatment (Nies, 1975).

The challenge to the nurse practitioner is to find the individual treatment program that offers the best control of blood pressure with the least side effects. A potential non-pharmaceutical adjunct to treatment is training in relaxation. Preliminary studies suggest that daily elicitation of the relaxation response will effectively lower blood pressure in some hypertensive persons. The focus of this study is to determine the effects of teaching the relaxation response as a systematic nursing intervention in the management of hypertension.

Hypertension

Hypertension is a condition in which there is an increased mean arterial pressure with elevations of both diastolic and systolic pressure. Most investigators consider a diastolic pressure above 90 mmHg and a systolic pressure above 140 mmHg as hypertension (Robbins, 1974, p. 1128). Ninety to ninety-five per cent of hypertension is of uncertain origin and is called primary or essential hypertension. The remaining five to ten per cent is secondary hypertension and in most instances is secondary to renal disease. Regardless of the primary cause, the hemodynamic abnormality in most hypertension is increased vascular resistance, especially at the level of the smaller muscular arteries and arterioles (Engelman & Graunmald, 1974, p. 188).

Epidemiologic studies (Kannel, Wolf, Verter & McNamara, 1970; Kannel, Castelli, McNamara, McKee & Feinleib, 1972) have shown that elevated blood pressure significantly increases the risk of cardiovascular and cerebrovascular disease. The Veterans Administration Cooperative Study Group on Antihypertensive Agents (1967, 1970) has shown that treatment of hypertension is of value in increasing life expectancy and reducing the incidence of cardiovascular, cerebral and renal complications. Unfortunately only a small fraction of the 23 million people in the United States with hypertension are adequately treated (Nies, 1975).

Although many factors involved in the development of essential hypertension have been delineated, the exact etiology is at present unknown. Integrating some of these factors into a theoretical case, Merrill (1970, p. 1252) describes a hypertensive individual as being particularly susceptible to vasomotor reactions resulting from a stressful environment. Reasons for this susceptibility might include emotional instability, a labile vasomotor apparatus including the vasomotor centers in the medulla, and a peripheral vasculature which hyperreacts to nervous constrictor stimuli. Early in life such an individual would manifest greater, more frequent and protracted rises in blood pressure in response to environmental stimuli. Merril postulates that the continued stress of pressure on a genetically sensitive vasculature might then result in the small blood vessel changes of essential hypertension.

The current therapeutic approach to hypertension emphasizes the use of pharmacologic agents that interfere with the sympathetic nervous system in maintaining abnormally elevated blood pressure (Kristt & Engel, 1975). Lovallo's (1975) review of clinical observations and experiments using the cold pressor test as a stressor in evaluating the autonomic activity in normal and hypertensive states further supports the role of the sympathetic nervous system and vasomotor lability in hypertension.

The activity of the sympathetic nervous system can be monitored by measuring plasma dopamine-beta-hydroxylase (DBH) levels (Stone, Gunnells, Robinson, Schanberg & Kirshner, 1974; Geffen, Rush, Louis & Doyle, 1973). DBH is the enzyme that catalyzes the conversion of dopamine to norepinephrine within the synaptic vesicles of the sympathetic neurons. Neurogenic stimulation causes the exocytosis of these vesicles with the release of norepinephrine and the simultaneous discharge of the soluble portion of DBH (Stone & DeLeo, 1976). The enzyme appears to have a longer metabolic half-life than catecholamines and there is no established pathway of excretion.

In a recent review of clinical studies (Kopin, Kaufman, Viveros, Jacabowitz, Lake, Ziegler, Lovenberg & Goodwin, 1976), it was reported that blood dopamine-beta-hydroxylase levels in normal individuals are elevated slightly by acute stresses with greater increases associated with prolonged stresses. Plasma DBH levels in relationship to hypertension and sympathetic activity have been studied by Stone et al. (1974). They found plasma DBH activity highest in patients with primary or essential hypertension. DBH activity differed significantly from the lower values observed in patients with secondary forms of hypertension. Geffen et al. (1973) reported proportionate increases in both plasma DBH and norepinephrine amounts with elevations in resting diastolic blood pressure.

Conflicting results were reported by Horwitz, Alexander, Lovenberg and Keiser (1973). They found that DBH activity varied widely and did not correlate with blood pressure or age. They concluded that because of relative insensitivity, serum DBH activity was not a satisfactory index of sympathetic function. According to Stone et al. (1974), these contradictory findings could reflect methodological differences in the assay procedure or differences in clinical classification of patients with hypertension rather than insensitivity of DBH activity.

In summary, the majority of experimental evidence supports the use of plasma DBH as an index of sympathetic nervous system activity. The research conducted by Stone et al. (1974) and Geffen et al. (1973) substantiates the conclusion that increased sympathetic nervous activity, as measured by plasma DBH, contributes to the elevation of blood pressure in essential hypertension.

Stress

According to Selye (1976), stress is the state manifested by the General Adaptation Syndrome which consists of all the nonspecifically induced changes within the biologic system. The first stage of the General Adaptation syndrome is the alarm reaction "fight or flight." This response is mediated by the sympathetic nervous system and can be consistently produced by electrical stimulation of the brain in the area extending from the anterior midbrain toward the hypothalamus (Benson, Beary & Carol, 1974). During acute pressor responses to stress there is an increased cardiac output and an increased vascular resistance in the kidney, splanchnic and skin areas associated with skeletal muscle vasodilitation in preparation for "fight or flight." The resting hemodynamic changes in essential hypertension are similar to those occurring in acute pressor responses to stress (Gutmann & Benson, 1971).

Gutmann and Benson (1971) and Lovallo (1975) found that the responses of hypertensive patients to stress were of longer duration with an exaggeration of visceral and skin vasoconstriction not balanced by a corresponding skeletal muscle vasodilation. In a recent study, Hodapp (1975) compared hypertensives and normotensives in non-stressful situations. Hypertensives not only reacted to emotionally stressful stimuli with increased sympathetic autonomic activation but also reacted to emotionally neutral weak stimuli which did not elicit a reaction in normotensive controls.

Because the true pressor load on the left ventrical is the integrated average pressure, the "fight or flight" response repeatedly elicited and maintained for long periods may ultimately lead to diseases of the vascular system. Benson (1975) suggests that the relaxation response may be useful in helping hypertensives to lower their blood pressure in environmental situations previously associated with the pressor response.

Relaxation

The relaxation response in humans consists of changes opposite to those of the stress response. The relaxation response appears to be an integrated hypothalamic response which results in generalized decreased sympathetic nervous system activity and perhaps also increased parasympathetic activity (Beary & Benson, 1974). Electrical stimulation in the area of the anterior hypothalamus results in adynamia of skeletal muscles, decrease in blood pressure, decrease in respiratory rate and pupil constriction (Beary & Benson, 1974).

One explanation for the decrease in blood pressure offered by Shoemaker and Tasto (1975) emphasizes muscular relaxation. The muscular relaxation may be changing the equilibrium of the vasodilation and vasoconstriction in the circulatory system so that the imbalance favors vasodilation. The vasodilation would decrease the peripheral resistance bringing about a lowering of blood pressure. Jacobson (1939) also found that systolic and diastolic blood pressure decreased with a relaxation technique that emphasized progressive deep muscle relaxation.

Another explanation for the decrease in blood pressure is offered by Wallace and Benson (1972) who studied physiological modifications in people who were practicing Transcendental Meditation to elicit the relaxation response. In contrast to muscular relaxation, meditation produced a complex of responses that marked a highly relaxed state rather than a single specific response. They describe a hypometabolic state with reductions in oxygen consumption, carbon dioxide elimination and the rate and volume of respiration, a slight increase in the acidity of the arterial blood, a marked decrease in the blood lactate level, a slowing of the heart beat, a considerable increase in skin resistance, and an electroencephalogram pattern of intensification of slow alpha waves with occasional theta waves. This hypometabolic state represents quiescence rather than hyperactivation of the sympathetic nervous system.

A variety of methods for eliciting the relaxation response have been reported in the literature. The methods include Transcendental Meditation, Zen and Yoga meditation, Western prayer methods, Progressive Relaxation, Autogenic Training and hypnosis (Benson, 1975). As diverse as these methods are they have certain commonalities essential for elicitation of the relaxation response. Each method requires a quiet environment with decreased stimuli. A passive attitude with disregard of distracting thoughts is encouraged. To shift away from logical, externally oriented thoughts, each method uses a constant stimulus, mind device or mantra. Decreased muscular tonus with a minimum of muscular work is common to all methods.

Beary and Benson (1974) found that the essential hypometabolic elements of the relaxation response can be induced by a simple technique. They studied seventeen healthy subjects for five consecutive periods. Three of the periods were control periods in which the subjects sat quietly and read. In one of the periods they were instructed to sit quietly with their eyes closed. During the other period they were instructed in the relaxation technique. Instructions for the relaxation period were: 1) Sit quietly in a comfortable position. 2) Close your eyes. 3) Deeply relax all your muscles, beginning at your feet and progressing to your face. Keep them deeply relaxed. 4) As you breathe out, say the word "ONE" silently to yourself. 5) Continue for ten to twenty minutes. 6) Maintain a passive attitude and permit relaxation to occur at its own pace.

During the practice of the relaxation technique oxygen consumption decreased 13 per cent, carbon dioxide production decreased 12 per cent, and respiratory rate decreased 4.6 breaths per minute. Simply sitting quietly with eyes closed or reading failed to produce statistically significant respiratory changes.

The effect of Transcendental Meditation on blood pressure has been well documented. The technique involves a mental device or mantra, a passive attitude, decreased muscle tonus and regular practice. In a study investigating borderline hypertensive persons, Benson, Rosner, Marzetta and Klemchuk (1974a) showed statistically significant decreases in blood pressure with the practice of Transcendental Meditation. Twenty-two borderline hypertensives taking no antihypertensive drugs were taught the meditation technique. During the premeditation control period blood pressures averaged 146.4 mmHg systolic and 94.6 mmHg diastolic. After an experimental period of 25 weeks systolic blood pressure decreased to 139.5 and diastolic blood pressures decreased to 90.8 mmHg. Benson et al. (1974b) extended the investigation to 14 pharmacologically treated hypertensive patients maintained on constant antihypertensive therapy. During the premeditation control period blood pressures averaged 146.6 mmHg systolic and 91.1 mmHg diastolic. After an experimental period of 20 weeks systolic blood pressure decreased to 135.0 mmHg and diastolic blood pressures decreased to 87 mmHg.

In a more recent study (Blackwell, Bloomfield, Gartside, Robins, Hanenson, Magenheim, Nidich & Zigler, 1976) the effects of Transcendental Meditation were observed on seven hypertensive persons. In the initial three month period there were significant reductions in home blood pressure readings in six of the seven individuals. In addition to the physiological effect of Transcendental Meditation on blood pressure, Blackwell et al. included the Spielberger state-trait anxiety scale to assess the psychological effects of Transcendental Meditation. It was found that six of the seven individuals had reduced state-anxiety scores after three months of meditation. A six month follow up indicated that out of the seven subjects, four gained substantial psychological benefit and two of these had significant and sustained reductions in blood pressure.

In these three studies the subjects served as their own controls during a premeditation control period. During the experimental period blood pressure was recorded during non-meditational periods of the day. Phase 5, the disappearance of the Korotkoff sound, was used as the criterion for determining diastolic blood pressure. The Transcendental Meditation was taught by Maharishi Mahesh Yogi to highly motivated volunteers selected from a group attending an introductory lecture to Transcendental Meditation.

In contrast to the three previous studies, a similar meditation technique was taught by the researcher to patients selected from a clinic population. The study was done at Yale University School of Nursing (Bloom, 1976). Two of the six patients who practiced the meditation technique described by Benson (1975) showed a significant drop in blood pressure. Comparison of post-meditation blood pressures within and between groups failed to show significant changes due to the relaxation technique. Bloom concluded that poor patient compliance was a possible explanation for the results. It is possible that the conflicting findings could be ascribed, at least in part, to a less motivated population and a less charismatic teacher.

Yoga has been used as a relaxation exercise in the management of hypertension. The Yoga exercises closely resemble the relaxation technique described in the previous four studies. The instructions include: 1) Lie flat with legs slightly apart and externally rotated, arms by the side with hands supine and fingers slightly flexed. 2) Eyes closed. 3) Breathe slowly and rhythmically. 4) Mentally go over each part of the body in regular sequence, allowing each part to relax completely. 5) After this relaxation the practice of mental concentration and meditation are introduced. Patel (1975a) described the technique as a psychophysical relaxation exercise based on yogic principles. Datey, Deshmukh, Dalvi and Vinekar (1967) used the word "Shavasan" to describe the same yogic exercise employed in their research.

Datey et al. (1967) studied the response of 47 hypertensive patients who were taught to practice the "Shavasan." Most of the patients were able to learn the exercise in three weeks. In patients not receiving antihypertensive drugs there was a significant reduction of 27 mmHg in the average mean blood pressure. In patients well controlled with drugs the drug requirement was gradually reduced keeping the mean blood pressure constant. It was possible to reduce the average drug requirement to 32 per cent of the original requirement in 13 of the 22 patients. Of the nine patients who did not respond to treatment, six did not practice the "Shavasan" regularly and three had arterio-sclerotic hypertension. Best results were obtained in patients with essential hypertension who practiced the "Shavasan" regularly.

Patel (1975a) studied the effects of Yoga with the addition of biofeedback to give the patients continuous audio-signal information about progress. Thirty-four hypertensive clinic patients were included in the study. Sixteen patients in the experimental group received instruction in the Yoga relaxation method and were encouraged to practice at home twice daily for six weeks. The control group patients were instructed to rest on a couch during their half-hour session. Results showed significant reductions in blood pressure in the experimental group. Systolic pressure decreased an average of 20.4 mmHg. Diastolic pressures decreased an average of 14.2 mmHg. The total drug requirement in 12 of the treatment patients fell by an average of 41.9 per cent. Results in the control patients showed that repetition of blood pressure measurements and increased medical attention alone did not reduce blood pressure or drug requirements. In a one-year follow up, Patel (1975b) found that the relaxation program was quite effective in maintaining reductions in blood pressure. However, patients reported that it was difficult to discipline themselves to 20 minutes of relaxation once or twice a day. They found that incorporating parts of the technique into their daily activity, at traffic lights, for example, was helpful.

With a program of Yoga relaxation it is not only possible to reduce the resting blood pressure and medication requirements but also the magnitude and duration of the rise in blood pressure associated with everyday stress. Patel (1975a) studied 34 hypertensive patients randomly assigned to either a control or a treatment group. The treatment group was trained in Yoga relaxation as previously described. Two stress tests were given, a cold pressor test and an exercise test, first at the beginning and again after six weeks of training. Maximum systolic and diastolic rises in blood pressure and recovery time in minutes were recorded. There was a statistically significant reduction in all the parameters in the treated group except for a systolic rise after exercise. It was concluded that relaxation with meditation is an effective way to reduce reactivity to stress and to hasten recovery from the effects of stress.

A Buddhist meditation exercise was used by Stone and DeLeo (1976) in a six-month trial to determine the effect of a relaxation technique on blood pressure. The relaxation technique was similar to that used by Beary and Benson (1974). Benson et al. (1974a, 1974b), Blackwell et al. (1976) and Bloom (1976). Stone and DeLeo expanded their study by including several physiological parameters not previously investigated in relaxation research. Fourteen patients treated with the relaxation technique and five control patients were studied. Plasma volume and plasma renin activity were measured. Dopamine-beta-hydroxylase levels were measured as an indication of alterations in peripheral sympathetic nervous system activity. After six months of relaxation mean arterial pressure in the supine and upright positions dropped an average of 12 mmHg, signficantly less than both their own base-line values and those of the control group. Furosemide-stimulated plasma renin activity showed a significant decrease in the treatment group. Since adrenergic activity influences renin secretory rate, it was hypothesized that a decrement of sympathetic tone was responsible for the change in plasma renin activity. The lack of correlation of plasma renin activity and mean arterial pressure suggests that a change in the rate of renin release was not the primary mechanism of blood pressure reduction. Patients in the treatment group exhibited an average plasma dopamine-beta-hydroxylase activity which was significantly less than both their own baseline values and those of control subjects. The observed relation of changes of DBH and blood pressure suggest that a reduction in peripheral adrenergic activity contributes to the reduction of blood pressure in relaxation therapy.

In summary, preliminary research using a variety of techniques to elicit the relaxation response shows the benefit of relaxation as a nonpharmaceutical adjunct to the treatment of hypertension. Best results were obtained with highly motivated people who practiced the technique regularly. The psychological benefit, the experience of self-control, the absence of drug side effects, and the absence of cost make it appealing to some hypertensive individuals.

In the reported research there has been little attention given to exploring relevant personality variables of the individuals studied. One possible personality construct which may be relevant to a person's response to treatment is the Locus of Control Scale (I-E Scale) developed by Rotter (1966). The 29 item I-E Scale measures the degree to which individuals perceive their rewards as being contingent on their own behavior or due to chance and independent of their behavior. Internally oriented individuals would believe that they are in control of their lives and responsible for the reinforcements they receive. Externally oriented individuals would believe that they are not in control of their lives because their life events are under the control of chance or powerful others.

Rotter's I-E Scale was used by DeGood (1975) in assessing the importance of "control" as a physiological indicator of stress. Blood pressure elevations were lowest where the personality and the situational control factor were congruous.

DeGood suggests that the extension of a model of coping behavior to humans requires a consideration of relevant attitudes and expectancies. Effective coping strategies would involve an interplay between personality and situational phenomena. Schallow (1975) evaluated the relationship between locus of control orientation and self-modification. He found that the most successful subjects were significantly more internally oriented than the least successful subjects. In a study done by Ray and Lamb (1974) a relationship was found between internal and external locus of control and the operant control of heart rate. The internally oriented subjects were better able to increase their heart rate and the externally oriented subjects were better able to decrease their heart rate. These studies suggest that physiological functioning is related to an individual's cognitive style and personality traits. Therefore, research in relaxation should consider both physiological and psychological parameters in order to identify hypertensive individuals who would benefit most from including a relaxation technique in their treatment plan.

Purpose of the Study

The main purpose of this study was to determine if a simple form of relaxation training could be taught by a nurse to hypertensive individuals and if this relaxation training would effectively reduce blood pressure. Three secondary purposes were to determine if there was: 1) a reduction in DBH activity with the use of a relaxation technique, 2) a reduction of anxiety, as measured by the State-Trait Anxiety Inventory, with the use of a relaxation technique, and 3) a relationship between perception of personal control, as measured on the I-E Scale, and reduction of blood pressure with the use of a relaxation technique.

Hypotheses

1. Participants who learn and practice the relaxation technique as described by Benson (1975) for six weeks will show a significant decrease in blood pressure when compared to participants who are not taught the relaxation technique.

2. Participants who learn and practice the relaxation technique for six weeks will show a significant decrease in Dopamine-beta-hydroxylase levels when compared to participants who are not taught the relaxation technique.

3. Participants who learn and practice the relaxation technique will show a significant decrease in STAI A-State scores when compared to participants who are not taught the relaxation technique.

4. Participants with internal orientation as measured by the I-E Scale will have greater reductions in blood pressure with the use of the relaxation technique than participants with external orientation.

CHAPTER II

METHODOLOGY

Subjects

The sample of participants for this study was drawn from the out-patient hypertension clinic at a 527 bed Veterans Administration Hospital. Criteria for selection of the study sample included:

1. Essential hypertension with clinic diastolic blood pressure measurements ranging from 90 mmHg to 115 mmHg.
2. Stabilization on hypertensive medication for at least four weeks prior to the study.
3. Ability to comprehend the instructions and follow the research protocol.
4. Residence in the Greater Metropolitan Area.
5. Not being treated for other major illnesses.
6. Not taking any major tranquilizers, more than two minor tranqilizers a week or using marijuana.

Design

This nine-week study was experimental in design, with one treatment group, one control group and random assignment of pairs matched for age by decade. There was a one-week pre-experimental period, a six-week experimental period and a two-week post-experimental period. The focus of the study was the manipulation of the independent variable, the use of the relaxation technique. Locus of control was an independent predicator variable. Three dependent variables were considered, blood pressure measurements, depamine-beta-hydroxylase levels and state anxiety as measured on Spielberger's STAI A-State scale.

Independent Variables

The technique described by Benson (1975) was used to elicit the relaxation response. The instructions included:

1. Sit quietly in a comfortable position.
2. Close your eyes.
3. Deeply relax all your muscles, beginning at your feet and progressing up to your face. Keep them relaxed.
4. Breathe through your nose. Become aware of your breathing. As you breathe out, say the word, "ONE," silently to yourself. For example, breathe IN. . . OUT, "ONE": IN. . .OUT, "ONE"; etc. breathe easily and naturally.
5. Continue for 10 to 20 minutes. You may open your eyes to check the time, but do not use an alarm. When you're finished, sit quietly for several minutes, at first with your eyes closed and later with your eyes open. Do not stand up for a few minutes.
6. Do not worry about whether you are successful in achieving a deep level of relaxation. Maintain a passive attitude and permit relaxation to occur at its own pace. When distracting thoughts occur, try to ignore them by not dwelling upon them and return to repeating "ONE." With practice, the reponse should come with little effort. Practice the technique twice daily, but not within two hours after any meal, since the digestive processes seem to interfere with the elicitation of the relaxation response (Benson, 1975, pp. 114-115).

Rotter's I-E Scale (See Appendix A) was administered to all participants during the pre-experimental period. This 29-item scale measures the degree to which individuals perceive their rewards as being contingent on their own behavior or due to chance and independent of their behavior (Rotter, 1966). Scores range from 0 to 19 with a mean score of 8. Low scores indicate an internal locus of control and high scores indicate an external locus of control. Internally oriented individuals would believe that they are in control of their lives and responsible for the reinforcement they receive. Externally oriented individuals would believe that they are not in control of their lives because life events are under the control of chance or powerful others. I-E Scale scores have been found to reliably differentiate individuals in a wide variety of situations (Throop & MacDonald, 1971).

Dependent Variables

Clinic blood pressure measurements were taken with a stethoscope, mercury sphygmomanometer and standard arm blood pressure cuff. The first Korotkoff sound was taken as the systolic pressure and the disappearance of Korotkoff sounds (Phase V) was taken as the diastolic pressure (Lancour, 1976). Measurements were taken with the participants in the sitting position. All measurements were done on the right arm. Clinic blood pressure measurements were done in the afternoon by the clinic nursing assistant who was uninformed of group assignment. A teaching stethoscope with two ear pieces was used once a week to check the nursing assistant's blood pressure readings with those of the researcher. Because of the busy schedule at the clinic occasional blood pressure recordings were taken by the researcher. The mean of eight clinic blood pressure measurements, four of the first and four from the second clinic visit, served as the pre-experimental blood pressure. At the end of the six-week experimental period the mean of eight clinic blood pressure measurements, four from each of the post-experimental clinic visits, were used as the post-experimental clinic blood pressure.

Home blood pressure measurements were taken with a stethoscope, aneroid hand sphygmomanometer, and standard arm blood pressure cuff. The method used for recording blood pressure in the clinic was taught to a family member. A teaching stethoscope with two ear pieces was used to check for accuracy. An acceptable degree of accuracy was defined as agreement within 4 mmHg with the researcher's reading on five consecutive readings. Daily home blood pressure measurements were done at a consistent time of day not directly following the relaxation period.

Dopamine-beta-hydroxylase levels were measured on all participants twice during the pre-experimental period and twice during the post-experimental period. These levels were used as an indication of alterations in peripheral sympathetic nervous system activity (Stone & Deleo, 1976). Five cubic centimeters of peripheral venous blood were collected in chilled vacuum tubes and placed on ice. After centrifugation, the supernatant plasma was separated and stored at -20 degrees centigrade. The method recommended by Nagatsu and Underfriend (1972) was used to analyze the plasma DBH level.

The third dependent variable was state anxiety. As an emotional process, anxiety refers to the sequence of cognitive, affective, and behavioral responses that occur as a reaction to some form of stress (Spielberger, 1972). The Spielberger State-Trait Anxiety Inventory (STAI) A-State scale was administered to all participants pre- and post-experimentally. The 40-item STAI (See Appendix A) measures transitory levels of anxiety (A-State) and dispositional levels of anxiety proneness (A-Trait). Scores range from a minimum of 20 points to a maximum of 80 points on both the A-State and A-Trait scales. Higher scores indicate increased anxiety. Scores on the A-State have been shown to decrease with relaxation training (Spielberger, Gorsuch & Lushene, 1970). Both A-State and A-Trait scales have a high degree of internal consistency. Test-retest reliability of the A-Trait scale is relatively high but the A-State scale tends to be low because it is designed to be influenced by situational factors (Spielberger et al., 1970). The STAI possesses both concurrent and construct validity (Spielberger et al., 1970).

Data Collection Procedure

During the pre-experimental clinic visit, patients were asked to participate in the study. Informed consent (See Appendix B) was obtained. Four blood pressure measurements were recorded by the clinic nursing assistant or the researcher. The STAI and I-E Scale were administered. For the first DBH level, 5cc of blood were drawn. A pill count was initiated to monitor compliance with medication regimen. The exact number of pills needed until the next clinic visit was dispensed. The participants were asked to return their pill bottles with any unused pills at each clinic visit. Appointments were made for a clinic visit followed by a home visit the next week.

During the second clinic visit, 5cc of blood were drawn for the second DBH level. Four blood pressure measurements were recorded. Participants returned their pill bottles with any unused pills.

All participants received a one-hour home visit from the researcher during the second week. A family member was taught to measure and record blood pressure. They were given a copy of instructions on blood pressure measurement (See Appendix C). Participants in the relaxation group received instructions in the relaxation technique (See Appendix C).

The procedure was explained, specific instructions were given and a trial session was conducted by the researcher. They were given relaxation diary forms (See Appendix C) and asked to supply the following information:

1. Daily blood pressure measurement.
2. Subjective level of relaxation experienced that day, rated on a five point scale.
3. Any extenuating circumstances which may have affected their relaxation.
4. The time at the beginning and ending of each relaxation period.

Blood pressure measurements and rating of relaxation were done at a consistent time of day, not directly following the relaxation period.

Participants in the control group were not taught the relaxation technique. They were told that they study was looking at relationships between relaxation and blood pressure. During the one-hour home visit a family member was taught to measure and record blood pressure. They were given relaxation diary forms (See Appendix C) and asked to supply the following information:

1. Daily blood pressure measurement.
2. Subjective level of relaxation experienced that day, rated on a five point scale.
3. Any extenuating circumstances which may have affected their relaxation.

Each two weeks all participants were seen at the clinic by the researcher. Four blood pressure measurements were recorded. The relaxation technique was reviewed with the participants in the relaxation group. Those who had not been regularly following the relaxation schedule were encouraged to begin doing so. Members of the relaxation group were required to use the relaxation technique at least 50 per cent of the twice daily scheduled times to continue in the study. Diary forms were collected and reviewed, and any questions were answered. Weekly mean relaxation scores and weekly mean home blood pressure measurements were calculated. Participants returned their pill bottles with any unused pills.

At the end of the six-week experimental period, 5cc of blood were drawn for the first post-experimental DBH level. Four post-experimental blood pressure measurements were recorded. Pill bottles and diary forms were collected. The STAI was repeated. The participants returned to the clinic the following week for the second post-experimental DBH level and the four final blood pressure measurements. The procedure is summarized in Table 1.

Analysis of Data

Means and standard deviations were calculated for all blood pressure measurements. Analyses of variance, Pearson product moment correlations and t-tests were applied to the data. The .05 confidence level was adopted as indicating a statistically significant difference.

Table 1

Design of Procedures for Participants in Both Groups

Time of Procedure	Group: Relaxation & Control Group	Group: Relaxation Group only
Pre-experimental Period		
Week 1, clinic visit		
Blood pressure X 4	X	
STAI & I-E Scale	X	
DBH level	X	
Pill count	X	
Experimental Period		
Week 2, clinic visit		
Blood pressure X 4	X	
DBH level	X	
Pill count	X	
Week 2, home visit		
Relaxation tech. taught		X
BP measurement taught	X	
Record keeping instruction	X	
Week 4 & 6, clinic visit		
Blood pressure X 4	X	
Review relaxation		X
Collect diary records	X	
Pill count	X	
Post-experimental period		
Week 8, clinic visit		
Blood pressure X 4	X	
DBH level	X	
Collect diary records	X	
Pill count	X	
Week 9, clinic visit		
Blood pressure X 4	X	
DBH level	X	
STAI	X	

CHAPTER III

RESULTS

Twenty-one male patients were asked to participate in this study. Two refused because of conflicting time schedules. Four patients were started in the study and subsequently dropped; one did not meet blood pressure criteria for the study; one had medication changes during the experimental period, and two were unable to follow the relaxation instructions and did not use the relaxation technique at least once each day. Fifteen participants completed the study, eight in the relaxation group and seven in the control group. The mean age of participants was 51 years, SD 8.4, for the relaxation group and 47.4 years, SD 7.1 for the control group. Results of the pill count revealed greater than 80 per cent compliance with medication regimen for all participants throughout the study.

Hypothesis Number 1 stated that participants who learn and practice the relaxation technique for six weeks would show a significant decrease in blood pressure when compared to participants who were not taught the relaxation technique. The dependent variable, blood pressure, included both clinic and home systolic and diastolic blood pressure measurements (in mmHg). A preliminary analysis of variance with repeated measures (See Table A) was applied to clinic systolic blood pressure measurements to determine if the mean of four clinic blood pressure measurements would be the best estimate of each clinic visit blood pressure measurement. Results revealed no significant difference, F (3, 356) = 1.061, $p < .05$. An analysis of variance with repeated measures (See Table A) was also applied to home systolic blood pressure measurements to determine if the mean of seven daily home blood pressure measurements would be the best estimate of each weekly home blood pressure measurement. Results revealed no significant difference, F (6, 6623) = 0.145, $p < .05$. Thus, clinic and home blood pressure measurements will be expressed as mean blood pressure measurements that represent either four clinic or seven home blood pressure measurements.

In order to determine if the relaxation and control groups were equivalent prior to experimental treatment, analysis of variance (See Table B) was applied to both initial mean systolic and initial mean diastolic blood pressure measurements in both the clinic and home situation. Results indicate that the relaxation and control groups did not differ on these measures at the beginning of the study. Thus, the blood pressure data to follow are expressed as difference scores from a starting baseline of zero.

Mean clinic systolic and diastolic blood pressure measurements are shown in Table 2. The results are summarized in Figure 1 where group mean blood pressure difference scores are plotted as a function of time. A two-factor analysis of variance with repeated measures (See Table 3) was applied to individual systolic blood pressure difference scores revealing a statistically significant difference between the relaxation and control groups, F (1, 13) = 5.64, $p < .05$. For clinic diastolic blood pressure difference scores, a two-factor analysis of variance with repeated measures revealed no significant difference between the relaxation and control groups, F (1, 13) = 3.15 $p < .05$. However, this later F value was significant at $p < .10$.

Mean home systolic and diastolic blood pressure measurements are shown in Table 4. The results are summarized in Figure 2 where group mean blood pressure difference scores are plotted as a function of time. A two-factor analysis of variance with repeated measures (See Table 5) was applied to the individual difference scores revealing no statistically significant difference between the relaxation and control groups for both systolic and diastolic home blood pressure, F (1, 13) = 1.88, $p < .05$ and F (1. 13) = 1.60, $p < .05$ respectively.

Summarizing for hypothesis number one, the relaxation group showed a significant decrease in clinic systolic blood pressure only. Therefore, hypothesis number one was accepted for clinic systolic blood pressure and rejected for clinic diastolic, home systolic and home diastolic blood pressure.

To further explore the blood pressure difference scores, additional analyses were applied to the data. First, Pearson product moment correlation coefficients (See Table 6) were computed comparing systolic and diastolic blood pressure difference scores for both groups. The coefficients for clinic and home situations were positive, .81 and .35 respectively. The coefficient for systolic and diastolic difference scores in the clinic situation was reliably different from zero. This suggests that in the clinic participants showing the greatest systolic blood pressure reductions tend also to show the greatest diastolic blood pressure reductions. Second, correlations computed for the relaxation group comparing blood pressure difference scores and frequency of using the relaxation technique (See Table 7) failed to reveal coefficients reliably different from zero. Third, to investigate the difference between clinic and home blood pressure measurements, t-tests were computed. The results show a statistically significant difference between clinic and home blood pressure measurements, $\underline{t}$ (13) = 4.88, $\underline{p} < .005$ for systolic and $\underline{t}$ (13) = 15.09, $\underline{p} < .005$ for diastolic blood pressure. Fourth, correlations computed for clinic and home blood pressure difference scores failed to

Table 2

Mean Clinic Systolic and Diastolic
Blood Pressure, Relaxation and Control Groups

Time	Systolic		Diastolic	
	Mean	SD	Mean	SD
Relaxation Group				
Pre-experimental	152.93	14.17	101.93	7.46
Week 4	147.43	17.66	99.87	11.29
Week 6	148.31	17.87	98.87	10.14
Post-experimental	145.43	18.25	98.12	11.44
Control Group				
Pre-experimental	144.35	7.76	98.20	4.51
Week 4	149.78	10.21	100.78	5.95
Week 6	145.64	7.60	98.85	6.05
Post-experimental	142.66	4.35	97.63	4.69

Figure 1

Clinic Systolic and Diastolic Mean Blood Pressure for Both Groups Expressed as difference Scores

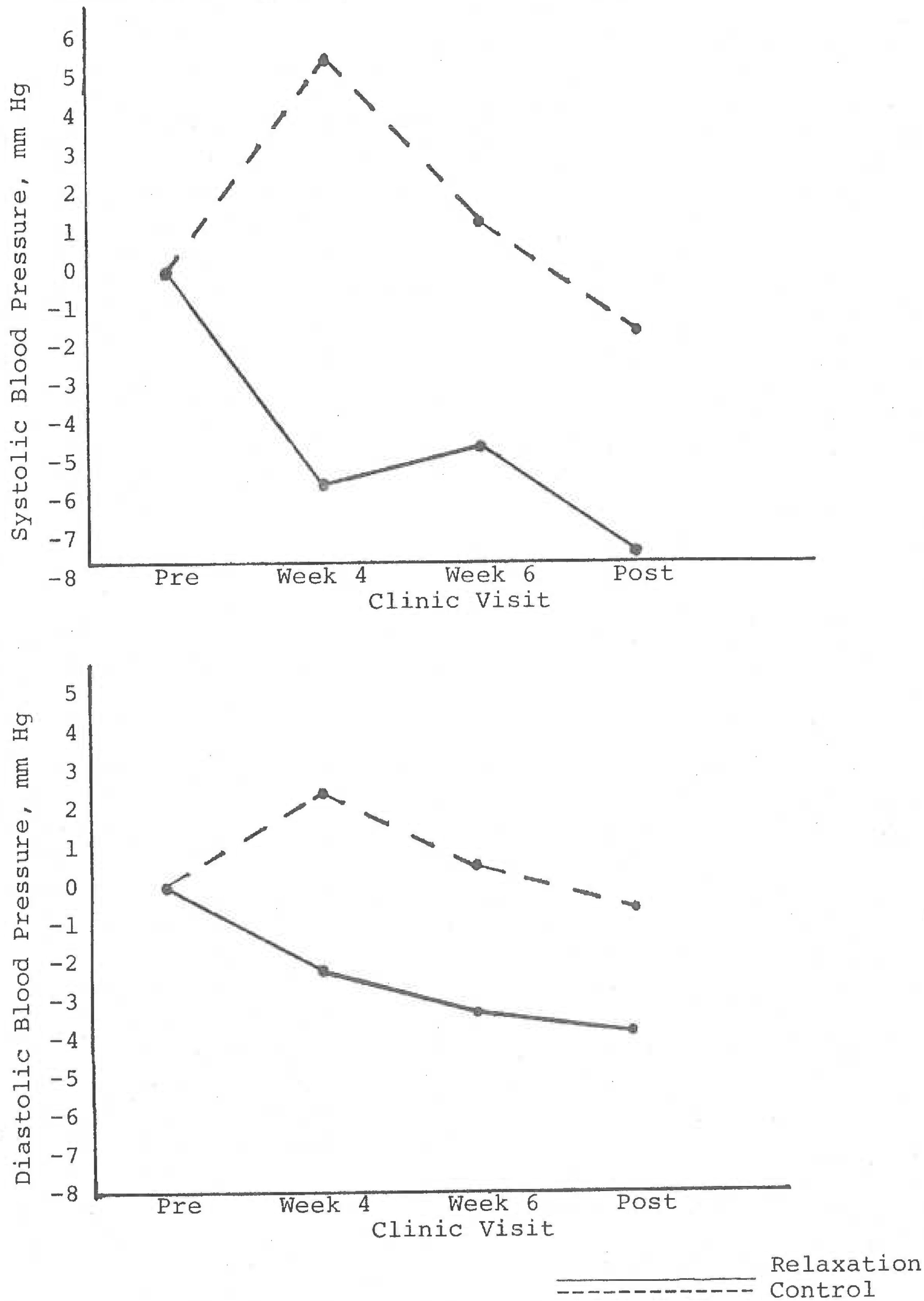


Table 3

Analysis of Variance
Individual Clinic Systolic and Diastolic
Blood Pressure Difference Scores

Source of Variance	df	SS	MS	F
Clinic Systolic				
Treatment (A)	1	738.183	738.183	5.641*
S	13	1701.133	130.856	
Visit (B)	2	161.090	80.545	3.192
AB	2	61.556	30.778	1.219
BS	26	656.037	25.232	
Clinic Diastolic				
Treatment (A)	1	183.945	183.945	3.150
S	13	758.973	58.382	
Visit (B)	2	48.632	24.316	3.172
AB	2	4.165	2.082	0.271
BS	26	199.278	7.664	

*p <.05

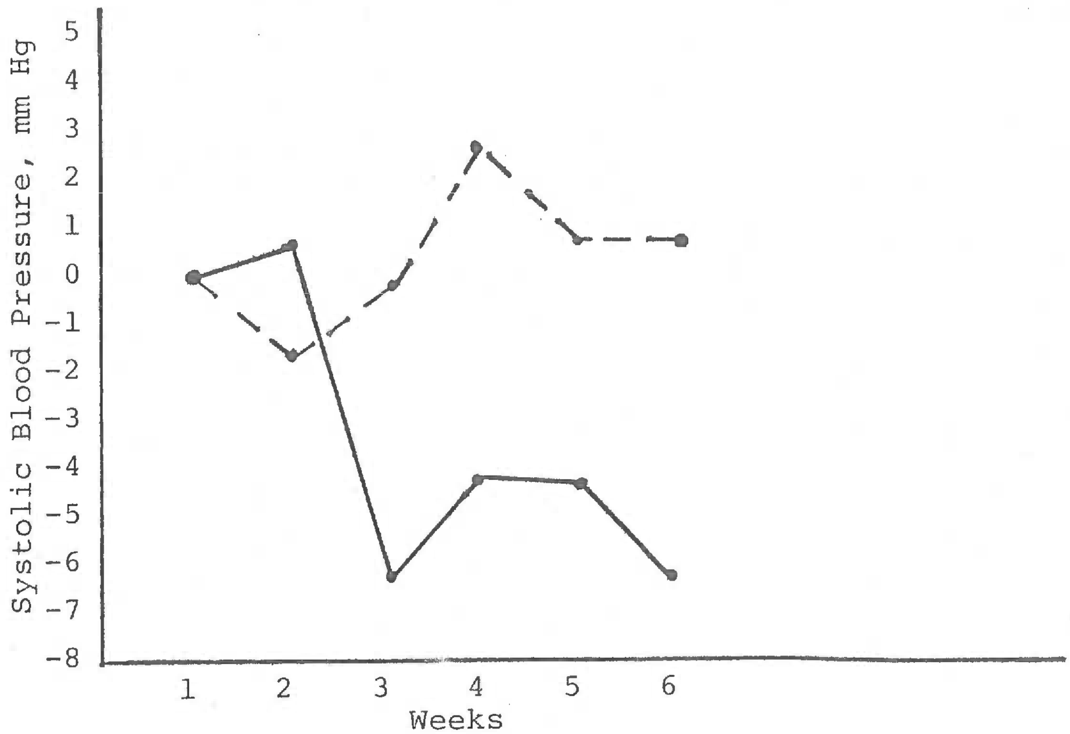
Table 4

Mean Home Systolic and Diastolic
Blood Pressure, Relaxation and Control Groups

Time	Systolic		Diastolic	
	Mean	SD	Mean	SD
Relaxation Group				
Week 1	145.30	18.36	89.17	6.63
Week 2	145.76	22.51	88.69	9.13
Week 3	139.08	15.24	86.26	6.20
Week 4	141.23	20.01	86.01	7.61
Week 5	140.92	13.93	86.03	4.47
Week 6	138.72	14.91	84.99	5.40
Control Group				
Week 1	134.72	12.27	87.02	7.77
Week 2	132.99	10.98	85.94	8.05
Week 3	134.57	12.49	87.70	9.58
Week 4	137.70	10.75	91.34	11.74
Week 5	135.40	11.89	85.71	11.19
Week 6	135.35	9.48	89.09	9.43

Figure 2

Home Systolic and Diastolic Mean Blood Pressure for Both Groups Expressed as Difference Scores



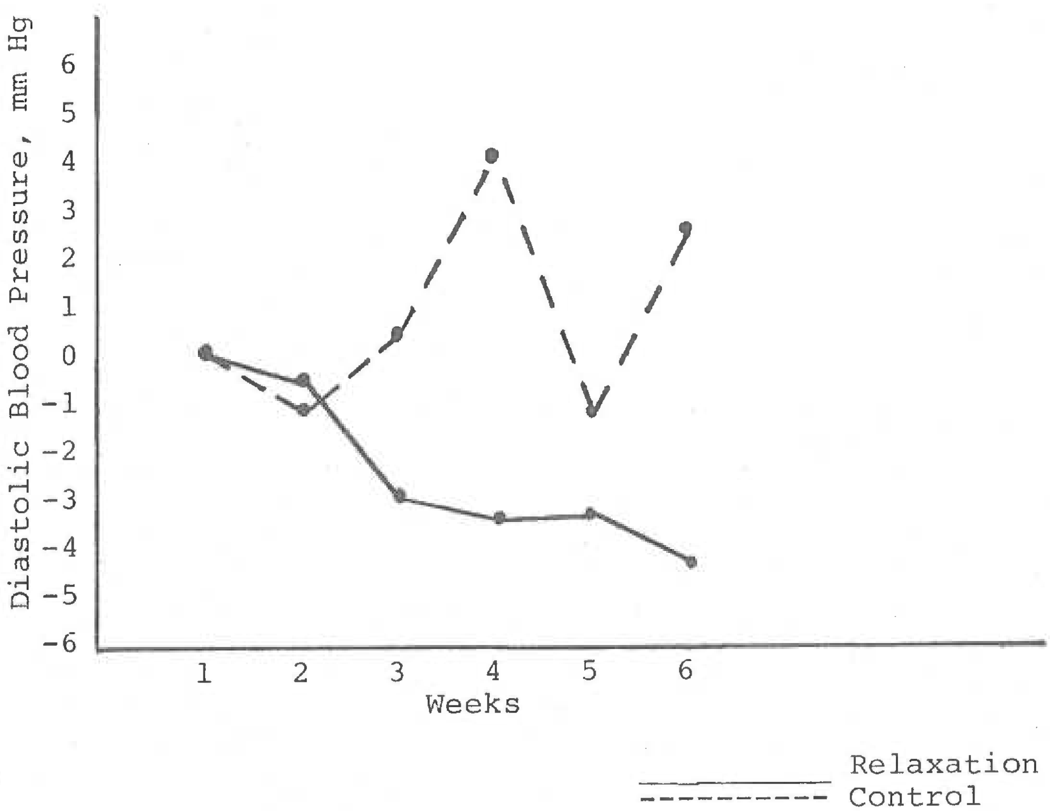


Table 5

Analysis of Variance
Individual Home Systolic and Diastolic
Blood Pressure Difference Scores

Source of Variance	df	SS	MS	F
Home Systolic				
Treatment (A)	1	433.118	433.118	1.885
S	13	2986.813	229.754	
Week (B)	4	78.377	19.594	0.496
AB	4	188.879	47.219	1.195
BS	52	2053.131	39.483	
Home Diastolic				
Treatment (A)	1	273.620	273.620	1.608
S	13	2211.051	170.080	
Week (B)	4	72.814	18.203	0.912
AB	4	178.006	44.501	2.230
BS	52	1037.411	19.950	

Table 6

Correlation Matrix of Blood Pressure, DBH and Personality Variables for Relaxation and Control Groups

	Locus of Control 1	Clinic Systolic B.P. 2	Clinic Diastolic B.P. 3	Home Systolic B.P. 4	Home Diastolic B.P. 5	State Anxiety Scores 6	Subjective Relaxation Scores 7	Frequency Daily B.P. 8	DBH Level 9
1		.07	-.12	.09	-.21	-.42	-.02	.49*	.24
2			.81**	.38	.19	.02	-.07	.27	.39
3				.07	.04	.06	.08	-.07	.18
4					.35	.13	.22	.06	.31
5						.17	.33	.11	-.11
6							.70**	-.01	-.05
7								-.09	-.23
8									.53*

$p < .05$*
$p < .005$**

Table 7

Correlation Matrix of Blood Pressure, DBH and Personality Variables for the Relaxation Group

Locus of Control	Clinic Systolic B.P.	Clinic Diastolic B.P.	Home Systolic B.P.	Home Diastolic B.P.	State Anxiety Score	Subjective Level of Relaxation	Frequency Relaxation Technique	DBH Level
1	2	3	4	5	6	7	8	9
1	.17	-.05	.46	-.32	-.32	.04	.59	.77**
2		.84**	.14	.10	.09	-.24	-.18	.49
3			-.05	.03	.08	.00	-.53	.11
4				-.03	-.11	.14	.61	.38
5					.82**	.58	.13	-.17
6						.56	-.24	-.41
7							.05	-.32
8								.69*

$p < .05$*

$p < .01$**

reveal a reliable difference from zero. This suggests that individuals showing the greatest clinic blood pressure reductions did not tend to show the greatest home blood pressure reductions.

Hypothesis number two stated that participants who learn and practice the relaxation technique would show a significant decrease in dopamine-beta-hydroxylase (DBH) levels when compared to participants who were not taught the relaxation technique. DBH levels will be reported in International Units (I.U.) which represent (μmol/min)/liter of serum at 37 degrees centigrade.

A preliminary analysis of variance with repeated measures (See Table C) was applied to the DBH levels to determine if the mean of two pre-experimental DBH levels and the mean of two post-experimental DBH levels would be the best estimate of pre- and post-experimental DBH levels respectively. Results revealed no significant difference, F (3, 56) = 0.070, $p < .05$. Thus, the DBH levels to follow are mean levels representing either two pre-experimental or two post-experimental DBH levels.

Results show that DBH levels for the relaxation group ranged from 1.83 I.U. to 57.6 I.U. with a pre-experimental mean of 38.5 I.U., SD 20.6, decreasing to 36 I.U., SD 17.4 post-experimentally. For the control group, DBH levels ranged from 14.5 I.U. to 83.3 I.U. with a pre-experimental mean of 60.5 I.U., SD 19.5, increasing to 60.8 I.U., SD 21.6, post-experimentally.

Analysis of variance (See Table 8) applied to individual DBH difference scores revealed no statistically significant difference between groups, F (1. 13) = .751, $p < .05$. Therefore, hypothesis number two was rejected. To further explore the DBH data, correlation coefficients were computed (See Table 7) for DBH difference scores and blood pressure difference scores. Results show none of these coefficients to be reliably different from zero. However, DBH difference scores and clinic systolic blood pressure difference scores approached significance.

Hypothesis number three stated that participants who learn and practice the relaxation technique would show a significant decrease in STAI A-State scores when compared to participants who were not taught the relaxation technique. The dependent variable, STAI A-State scores are reported as standard scores with a mean of 50 and SD of 10. The relaxation groups pre-experimental A-State score of 50 did not change over time. The control groups pre-experimental A-State score of 48 dropped to 46 post-experimentally. An analysis of variance (See Table 9) applied to the individual between groups, F (1, 13) = .114, $p < .05$. Therefore, hypothesis number three was rejected.

In addition to the STAI, participants rated their daily level of relaxation on a scale ranging from 1 (most relaxed) to 5 (least relaxed). The relaxation and control groups did not differ on how they rated their level of relaxation. The experimental group decreased .21 points from 2.93 the first week to 2.72 the last week. The control group decreased .26 points from 2.79 the first week to 2.53 the last week. A Pearson product moment correlation (See Table 6) comparing A-State scores with subjective ratings of relaxation for both groups revealed a coefficient of .70, $p < .005$ which is reliably different from zero. This suggests that people who rate themselves as being subjectively more relaxed post-experimentally tend to also score less anxious on the post-experimental STAI A-State scale.

Hypothesis number four stated that participants with internal orientation as measured by the I-E Scale would have greater reductions in blood pressure with the use of the relaxation technique than participants with external orientation. The relaxation group I-E Scale scores ranged from 2 to 16 with a mean of 9. Three participants were below the mean (internal) and five participants were above the mean (external). Pearson product moment correlations (See Table 7) were computed for I-E Scale scores and blood pressure difference scores using the relaxation group only. None of the coefficients were reliably different from zero.

Table 8

Analysis of Variance
DBH Difference Scores

Source of Variance	df	SS	MS	F
Between Groups	1	31.4785	31.4785	.751
Within Groups	13	544.8967	41.9153	
Total	14	576.3753		

Table 9

Analysis of Variance
STAI, A-State Difference Scores

Source of Variance	df	SS	MS	F
Between Groups	1	5.6678	5.6678	.114
Within Groups	13	642.7321	49.4409	
Total	14	648.4		

Therefore, hypothesis number four was rejected.

To further investigate I-E Scale scores, a correlation was computed comparing I-E Scale scores and frequency of recording daily blood pressure. Results revealed a coefficient of .49 which is reliably different from zero. This suggests that externally oriented individuals tend to record their daily blood pressure more frequently than internally oriented individuals. A correlation using only the relaxation group (See Table 7) compared I-E Scale scores and frequency of using the relaxation technique. Results revealed a coefficient of .59 which does not differ reliably from zero.

CHAPTER IV

DISCUSSION

Results of this study show that subjects in the relaxation group achieved a significant reduction of 7.5 mmHg in clinic systolic blood pressure when compared to the control group reductions of 1.7 mmHg. The clinic diastolic blood pressure reduction of 3.8 mmHg approached statistical significance when compared to a reduction of 0.6 mmHg for the control group. Although clinic diastolic reductions were not statistically significant, it is interesting to note the similarity in systolic and diastolic decreases shown in Figure 1. In addition, clinic diastolic decreases were reliably related to clinic systolic decreases which were statistically significant. These blood pressure reductions are consistent with the findings of Benson et al. (1974a and 1974b) who reported reductions of 6.9 mmHg systolic and 3.8 mmHg diastolic blood pressure for borderline hypertensives and reductions of 11.6 mmHg systolic and 4.1 mmHg diastolic blood pressure in treated hypertensives.

Patel's (1975a) investigation which was similar to the present study in duration, outpatient clinic setting and relaxation technique taught by a health care provider, reports much larger decreases of 20.4 mmHg systolic and

14.2 mmHg diastolic blood pressure. One difference that may account for Patel's larger blood pressure reductions is the inclusion of biofeedback instruments to give the patients continuous information about their progress. The present findings and those of Patel agree that repetition of blood pressure measurements and increased health care attention without relaxation training did not reduce blood pressure in the control group.

In addition to assessing clinic blood pressure, the present study along with Blackwell et al. (1976) has expanded the scope of relaxation research by including home blood pressure measurements. Although the present study did not reach statistical significance for home blood pressure reductions, clinical benefit should be considered. Reductions in home blood pressure of 6.6 mmHg systolic and 4.9 mmHg diastolic for the relaxation group did not differ statistically from increases of 0.6 mmHg systolic and 2.1 mmHg diastolic for the control group. These results are in agreement with those of Blackwell et al. (1976) who report a mean group reduction of 7.48 mmHg systolic and 6.09 mmHg diastolic blood pressure. Interestingly, these studies showed similar results even though participants in Blackwell's study practiced a relaxation technique twice as long as participants in the present study.

One unanticipated finding of this study was the degree to which home blood pressure measurements differ from clinic blood pressure measurements. Initially, home blood pressure measurements were 8.63 mmHg systolic and 11.97 mmHg diastolic lower than clinic blood pressure measurements. This difference remained fairly consistent throughout the study. In addition, results revealed that clinic blood pressure difference scores were not reliably related to home blood pressure difference scores. This suggests that participants with the greatest blood pressure reductions in the clinic did not necessarily have the greatest blood pressure reductions in the home setting. Therefore, clinic blood pressure changes did not accurately represent home blood pressure changes. The clinical implications of these findings point to the importance of monitoring home blood pressure in the management of hypertension. As Niles (1975) points out most side effects from antihypertensive drugs are extensions of the pharmacologic actions of these drugs. Adjusting the dosage of antihypertensive medication based on clinic blood pressure measurements that are 8.63 mmHg systolic and 11.97 mmHg diastolic higher than home blood pressure measurements could result in undesirable side effects from over treatment leading to poor compliance with medication regimen.

Home blood pressure measurements also appeared to be a sensitive indicator of change in environmental stressors. One man was unexpectedly laid off work and had a blood pressure increase of 24 mmHg systolic and 20 mmHg diastolic from the previous day returning to baseline blood pressure after two days. Another man threatened by an impending layoff had a weekly mean blood pressure of 17 mmHg systolic and 13 mmHg diastolic higher than the preceding and following weeks. In contrast, one man took a needed week-long vacation and had a 7 mmHg systolic and 5.5 mmHg diastolic decrease in blood pressure which subsequently returned to baseline the following week.

In the present investigation, DBH activity remained unchanged in both the relaxation and control groups. The stability of DBH levels in this study confirms the report of Nagatsu et al. (1972). Stone et al. (1976) observed the same stability of DBH levels for their control group. In contrast, they report a significant reduction of DBH activity in subjects using a relaxation technique. They also report a significant correlation of change in mean arterial pressure with alterations in DBH activity. In the present study, correlations for change in blood pressure with alterations in DBH activity approached significance for clinic systolic blood pressure. Perhaps significance would have been reached if this study had continued for six months as did Stone's research.

A further difference that deserves consideration is that subjects in Stone's study had never received antihypertensive drug therapy while subjects in this study had been stabilized on antihypertensive medication for at least four weeks prior to the study. DBH levels were used as an index of adrenergic activity. Possibly, the use of antihypertensive drugs that block the function of the sympathetic nervous system interfered in some way with the anticipated change in DBH levels.

In contrast to the studies of Blackwell et al. (1976) and Spielberger et al. (1970), this study revealed no change in STAI A-State scores for participants using the relaxation technique. Likewise, daily subjective rating of relaxation failed to detect a difference between groups. Although these paper and pencil measurements did not show a difference between the relaxation and control groups, 7 of the 8 participants in the relaxation group reported subjective psychological benefits which included feeling relaxed, sleeping better, and being less excitable. Participants in the control group did not report changes in relaxation, sleep pattern or excitability. While further research may account for this discrepancy, the present findings suggest that STAI A-State scores and daily ratings of relaxation do not reflect the benefits of the relaxation technique indicated by verbal report.

Nevertheless, results of this study do show a significant correlation of change in STAI A-State scores with change in subjective relaxation ratings. This suggests that participants who score less anxious post-experimentally tend also to rate themselves more relaxed post-experimentally. It is difficult to relate this finding to the fact that STAI A-State scores and relaxation ratings did not reflect the benefits of the relaxation technique indicated by verbal report. Perhaps the paper and pencil measures were sensitive to some dimension of anxiety or relaxation that was different than spontaneous verbal reports of psychological benefit.

Unlike Schallow's (1975) findings, results of this study indicate that locus of control orientation did not accurately predict which individuals would most successfully use a self-modification program.

One possible explanation for these contradictory findings is that in the present study a structured program designed by the researcher was assigned to the participants, while in Schallow's study participants were given self-modification principles and told to design and carry out their own program. As DeGood (1975) indicates, extension of a model of coping behavior to humans requires a consideration of relevant attitudes and orientations. This assumption is supported by the present study's finding that externally oriented individuals were more compliant in terms of following this structured research protocol. Therefore, future research may show that externally oriented individuals

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

A major problem in the management of hypertension is the wide range of side effects from antihypertensive drugs. A potential non-pharmaceutical adjunct to treatment is training in relaxation. Therefore, 15 patients from a Veterans Administration outpatient hypertension clinic participated in this nine-week investigation of a relaxation technique. The design of the study was experimental with random assignment of participants to either a relaxation or a control group. The relaxation group was taught Benson's (1975) relaxation technique and asked to practice it twice daily for six weeks. Home visits were made to all participants for relaxation training and/or record keeping instructions. Participants in both groups were asked to record their blood pressure and level of relaxation daily. To determine DBH levels, 5cc of venous blood were drawn twice pre- and twice post-experimentally. The I-E Scale was administered pre-experimentally and the STAI was administered pre- and post-experimentally.

Independent variables, the relaxation technique and locus of control orientation as measured on Rotter's I-E

Scale were tested for their possible relationship to the dependent variables of blood pressure, dopamine-beta-hydroxylase levels and anxiety as measured on Spielberger's STAI A-State scale. Analyses of variance, Pearson product moment correlations and t-tests were used to analyze the data.

Clinic systolic blood pressure measurements revealed a significant decrease of 7.5 mmHg for the relaxation group compared to a decrease of 1.7 mmHg for the control group. Clinic diastolic blood pressure measurements revealed a nonsignificant decrease of 3.8 mmHg for the relaxation group compared to 0.6 mmHg for the control group. Home blood pressure measurements revealed a nonsignificant decrease of 6.6 mmHg systolic and 4.9 mmHg diastolic for the relaxation group compared to an increase of 0.6 mmHg systolic and 2.1 mmHg diastolic for the control group. Participants showing decreases in systolic blood pressure tended to show decreases in diastolic blood pressure. With all participants considered, home blood pressure measurements were significantly lower than clinic blood pressure measurements. Changes in clinic blood pressure were not related to changes in home blood pressure measurements. DBH levels did not differ between groups or change over time. Blood pressure difference scores were not reliably related to DBH level difference scores. STAI A-State scores and subjective rating of relaxation did not differ between groups or change over time. I-E Scale scores were not related to blood pressure difference scores for the relaxation group. However, individuals with high (external) scores tended to record their daily blood pressure more frequently than individuals with low (internal) scores on the I-E Scale.

Conclusion

The present study has suggested that (1) the relaxation technique is useful in reducing clinic systolic blood pressure and as such has implications for use as a nursing intervention in the treatment plan for hypertensive individuals, (2) DBH levels, possibly reflecting sympathetic nervous system activity are unaffected by six-weeks use of the relaxation technique, (3) anxiety, as measured by STAI A-State Scale is unaffected by six-weeks use of the relaxation technique, and (4) Locus of control orientation, as measured on the I-E scale does not accurately predict which individuals would most benefit from the use of the relaxation technique. Additional conclusions not directly related to the four hypotheses were suggested by the study. First, blood pressure measurements recorded in the clinic situation are higher than, and do not accurately represent, home blood pressure measurements. Second, individuals who lower their systolic blood pressure using the relaxation technique are likely to also lower their diastolic blood pressure. Third, externally oriented individuals are more compliant than internally oriented individuals in terms of following this type of research protocol.

Recommendations for Further Study

On the basis of the present study, it is suggested that the following recommendations be considered:

1. Future studies investigating the relaxation response could explore additional variables including sex and age.

2. Replication of this study using different relaxation techniques and combinations of techniques would contribute to the existing body of knowledge in relaxation.

3. Subsequent research in hypertension should include monitoring home blood pressure.

4. Long term outcome studies in relaxation training should be emphasized.

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APPENDICES

APPENDIX A

Data Collection Instruments

1. Rotter's I-E Scale
2. State-Trait Anxiety Inventory

Rotter's I-E Scale

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair which you more strongly believe to be the case as far as you are concerned. Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice.

1.a. Children get into trouble because their parents punish them too much.
  b. The trouble with most children nowadays is that their parents are too easy with them.

2.a. Many of the unhappy things in people's lives are partly due to bad luck.
  b. People's misfortunes result from the mistakes they make.

3.a. One of the major reasons why we have wars is because people don't take enough interest in politics.
  b. There will always be wars, no matter how hard people try to prevent them.

4.a. In the long run people get the respect they deserve in this world.
  b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5.a. The idea that teachers are unfair to students is nonsense.
  b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6.a. Without the right breaks one cannot be an effective leader.
  b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7.a. No matter how hard you try some people just don't like you.
  b. People who can't get others to like them don't understand how to get along with others.

8.a. Heredity plays the major role in determining one's personality.
  b. It is one's experiences in life which determine what they're like.

9.a. I have often found that what is going to happen will happen.
b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10.a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11.a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
b. Getting a good job depends mainly on being in the right place at the right time.

12.a. The average citizen can have an influence in government decisions.
b. This world is run by the few people in power, and there is not much the little guy can do about it.

13.a. When I make plans, I am almost certain that I can make them work.
b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14.a. There are certain people who are just no good.
b. There is some good in everybody.

15.a. In my case getting what I want has little or nothing to do with luck.
b. Many times we might just as well decide what to do by flipping a coin.

16.a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17.a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
b. By taking an active part in political and social affairs the people can control world events.

18.a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
b. There really is no such thing as "luck."

19.a. One should always be willing to admit mistakes.
b. It is usually best to cover up one's mistakes.

20.a. It is hard to know whether or not a person really likes you.
b. How many friends you have depends upon how nice a person you are.

21.a. In the long run the bad things that happen to us are balanced by the good ones.
b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22.a. With enough effort we can wipe out political corruption.
b. It is difficult for people to have much control over the things politicians do in office.

23.a. Sometimes I can't understand how teachers arrive at the grades they give.
b. There is a direct connection between how hard I study and the grades I get.

24.a. A good leader expects people to decide for themselves what they should do.
b. A good leader makes it clear to everybody what their jobs are.

25.a. Many times I feel that I have little influence over the things that happen to me.
b. It is impossible for me to believe that chance or luck plays an important role in my life.

26.a. People are lonely because they don't try to be friendly.
b. There's not much use in trying too hard to please people, if they like you, they like you.

27.a. There is too much emphasis on athletics in high school.
b. Team sports are an excellent way to build character.

28.a. What happens to me is my own doing.
b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29.a. Most of the time I can't understand why politicians behave the way they do.
b. In the long run the people are responsible for bad government on a national as well as on a local level.

SELF-EVALUATION QUESTIONNAIRE

A-State

		Not at All	Somewhat	Moder-ately So	Very Much So
1.	I feel calm	1	2	3	4
2.	I feel secure	1	2	3	4
3.	I am tense	1	2	3	4
4.	I am regretful	1	2	3	4
5.	I feel at east	1	2	3	4
6.	I feel upset	1	2	3	4
7.	I am presently worrying over possible misfortunes	1	2	3	4
8.	I feel rested	1	2	3	4
9.	I feel anxious	1	2	3	4
10.	I feel comfortable	1	2	3	4
11.	I feel self-confident	1	2	3	4
12.	I feel nervous	1	2	3	4
13.	I am jittery	1	2	3	4
14.	I feel "high strung"	1	2	3	4
15.	I am relaxed	1	2	3	4
16.	I feel content	1	2	3	4
17.	I am worried	1	2	3	4
18.	I feel over-excited and "rattled"	1	2	3	4
19.	I feel joyful	1	2	3	4
20.	I feel pleasant	1	2	3	4

SELF-EVALUATION QUESTIONNAIRE

A-Trait

		Almost Never	Sometimes	Often	Almost Always
21.	I feel pleasant	1	2	3	4
22.	I tire quickly	1	2	3	4
23.	I feel like crying	1	2	3	4
24.	I wish I could be as happy as others seem to be	1	2	3	4
25.	I am losing out on things because I can't make up my mind soon enough	1	2	3	4
26.	I feel rested	1	2	3	4
27.	I am "calm, cool, and collected"	1	2	3	4
28.	I feel that diffi-culties are piling up so that I cannot overcome them	1	2	3	4
29.	I worry too much over something that really doesn't matter	1	2	3	4
30.	I am happy	1	2	3	4
31.	I am inclined to take things hard	1	2	3	4
32.	I lack self-confidence	1	2	3	4
33.	I feel secure	1	2	3	4
34.	I try to avoid facing a crisis or difficulty	1	2	3	4
35.	I feel blue	1	2	3	4
36.	I am content	1	2	3	4
37.	Some unimportant thought runs through my mind and bothers me	1	2	3	4
38.	I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39.	I am a steady person	1	2	3	4
40.	I get in a state of ten-sion or turmoil as I think over my recent concerns and interests	1	2	3	4

CONSENT FOR HUMAN RESEARCH PROJECT

I ____ herewith
(First name) (Middle initial) (Last name)
agree to serve as a subject in the investigation named, RELAXATION AS A NURSING INTERVENTION IN THE MANAGEMENT OF HYPERTENSION, conducted by Margaret McMahon, under the supervision of Dr. Rawlinson. The research aims to determine the usefulness of a relaxation technique for patients with hypertension.

I understand that my participation will involve:

1. Answering a questionnaire which relates to feelings and mood. This will take about 30 minutes.

2. Receiving a home visit from Margaret McMahon for the purpose of receiving relaxation and record keeping instructions. This will take approximately one hour.

3. Practicing relaxation for 10 to 20 minutes twice a day for six weeks and keeping a record of each session.

4. Having about ½ teaspoon of blood drawn four times.

5. Having a family member measure and record my blood pressure daily.

6. Returning to the hypertension clinic five times during the nine week study.

All information that I give will be handled confidentially. My anonymity will be maintained on all documents, which will be identified by means of code numbers.

My participation does not involve any known risks. I may not receive any direct benefit from participating in this project, but understand my contribution will help expand the degree of knowledge in regard to the treatment of persons who have hypertension.

I understand that I am free to withdraw from participation in this investigation at any time without affecting my medical treatment or my relationship with the Veterans Administration.

Margaret McMahon has offered to answer any questions I might have about the tasks required of me in this study.

I have read the foregoing information and agree to participate in the study described.

Signature ______________________________

Witness ______________________________

Date ___________________

CONSENT FOR HUMAN RESEARCH PROJECT

I ____ herewith
(First name) (Middle Initial) (Last name)

agree to serve as a subject in the investigation named, RELAXATION AS A NURSING INTERVENTION IN THE MANAGEMENT OF HYPERTENSION, conducted by Margaret McMahon, under the supervision of Dr. Rawlinson. The research aims to determine the usefulness of a relaxation technique for patients with hypertension.

I understand that my participation will involve:

1. Answering a questionnaire which relates to feelings and mood. This will take about 30 minutes.
2. Receiving a home visit from Margaret McMahon for the purpose of record keeping instructions for rating my level of relaxation once daily. The home visit will take approximately one hour.
3. Having about ½ teaspoon of blood drawn four times.
4. Having a family member measure and record my blood pressure daily.
5. Returning to the hypertension clinic five times during the nine week study.

All information that I give will be handled confidentially. My anonymity will be maintained on all documents, which will be identified by means of code numbers.

My participation does not involve any known risk. I may not receive any direct benefit from participating in this project, but understand my contribution will help expand the degree of knowledge in regard to the treatment of persons who have hypertension.

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Signature ______________________________

Witness ______________________________

Date ______________________________

APPENDIX C

Instructions and

1. How to Measure Blood Pressure
2. Relaxation Technique
3. Relaxation Diary Forms for Both Groups

HOW TO MEASURE BLOOD PRESSURE

1) Have the person sit with their right arm resting on a table and have the meter facing you.
2) Apply the blood pressure cuff snugly and smoothly. The cuff should be about one inch above the elbow joint. Avoid having tight clothing above the cuff.
3) Feel for the location of the brachial pulse, press the bell of the stethoscope over the brachial artery.
4) Inflate the cuff to a pressure about 30 points higher than their usual pressure. Slowly release the cuff pressure. The first sharp beat you hear is the systolic pressure reading. When the sound disappears it is the diastolic blood pressure reading.
5) Record the systolic first and then the diastolic, for example 140/90.
6) If you are not sure of your reading completely release the cuff pressure and wait a few minutes before trying again.

RELAXATION TECHNIQUE*

1. Sit quietly in a comfortable position.
2. Close your eyes.
3. Deeply relax all your muscles, beginning at your feet and progressing up to your face. Keep them relaxed.
4. Breathe through your nose. Become aware of your breathing. As you breathe out, say the word, "ONE," silently to yourself. For example, breathe IN ... OUT, "ONE"' IN ... OUT, "ONE"; Breathe easily and naturally.
5. Continue for 10 to 20 minutes. You may open your eyes to check the time, but do not use an alarm. When you finish, sit quietly for several minutes, at first with your eyes closed and later with your eyes opened. Do not stand up for a few minutes.
6. Do not worry about whether you are successful in achieving a deep level of relaxation. Maintain a passive attitude and permit relaxation to occur at its own pace. When distracting thoughts occur, try to ignore them by not dwelling upon them and return to repeating "ONE." With practice, the response should come with little effort. Practice the technique once or twice daily, but not within two hours after any meal, since the digestive processes seem to interfere with the elicitation of the Relaxation Response.

*Benson, H., The Relaxation Response, Wm. Marrow & Co., Inc. New York, 1975, p. 114-115.

Relaxation Diary Forms Relaxation Group

It is very important that you relax two times a day for six weeks. Please record the time that you begin and end each relaxation session.

Measure and record your blood pressure and level of relaxation daily. Choose a convenient time of day, not following the relaxation session. Use the same time each day.

Date________________________ Blood pressure________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Relaxation time: 1. begin_______________, end_______________

2. begin_______________, end_______________

Comments:____

Date________________________ Blood pressure________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Relaxation time: 1. begin_______________, end_______________

2. begin_______________, end_______________

Comments:____

Date________________________ Blood pressure________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Relaxation time: 1. begin_______________, end_______________

2. begin_______________, end_______________

Comments:____

Relaxation Diary Forms Control Group

It is important to measure and record your blood pressure and level of relaxation daily. Choose a convenient time of day. Use the same time each day.

Date ____________________ Blood pressure ________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Comments: ____________________

Date ____________________ Blood pressure ________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Comments: ____________________

Date ____________________ Blood pressure ________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Comments: ____________________

Date ____________________ Blood pressure ________________

Please circle the "X" that most closely describes the degree to which you are relaxed today.

X	X	X	X	X
not at all relaxed		partially relaxed		extremely relaxed

Comments: ____________________

APPENDIX D

Statistical Tables

1. Table A Analysis of Variance
   Four Clinic Systolic Pressures and
   Seven Home Systolic Pressures

2. Table B Analysis of Variance
   Initial Mean Systolic and Diastolic
   Blood Pressure

3. Table C Analysis of Variance
   Two DBH Levels, Pre and Post-
   Experimentally

Table A

Analysis of Variance
Four Clinic Systolic Pressures and
Seven Home Systolic Pressures

Source of Variance	df	SS	MS	F
Clinic systolic				
Between Groups	3	23912.577	7970.859	1.061
Within Groups	356	2674323.822	7512.145	
Total	359	2698236.400		
Home systolic				
Between Groups	6	237.260	39.543	0.145
Within Groups	623	169245.166	271.661	
Total	629	169482.426		

Table B

Analysis of Variance

Initial Mean Systolic and Diastolic
Blood Pressure

Source of Variance	df	SS	MS	F
Clinic Systolic				
Between Groups	1	307.884	307.884	1.868
Within Groups	13	2141.859	164.758	
Total	14	2449.744		
Clinic Diastolic				
Between Groups	1	678.637	678.637	1.379
Within Groups	13	6394.866	491.912	
Total	14	7073.503		
Home Systolic				
Between Groups	1	418.093	418.093	1.591
Within Groups	13	3414.136	262.625	
Total	14	3832.230		
Home Diastolic				
Between Groups	1	17.240	17.240	0.306
Within Groups	13	731.310	56.254	
Total	14	748.550		

Table C

Analysis of Variance
Two DBH Levels
Pre and Post-experimentally

Source of Variance	df	SS	MS	F
Between Groups	3	126.19	42.06	.070
Within Groups	56	33275.10	594.19	
Total	59	33401.30		

AN ABSTRACT OF THE CLINICAL INVESTIGATION OF

MARGARET A. McMAHON

for the Master of Nursing

Date of receiving this degree: June 11, 1977

Title: RELAXATION AS A NURSING INTERVENTION IN THE MANAGEMENT OF HYPERTENSION

Approved: [redacted]
(Professor in Charge of Clinical Investigation)

A major problem in the management of hypertension is the wide range of side effects from antihypertensive drugs. A potential non-pharmaceutical adjunct to treatment is training in relaxation. The purpose of this study was to determine if a simple form of relaxation training could be taught by a nurse to hypertensive individuals and if this relaxation training would effectively reduce blood pressure.

Fifteen patients from an out-patient hypertension clinic participated in this nine-week study. The design of the study was experimental with random assignment of participants to either a relaxation or a control group. The relaxation group was taught Benson's (1975) relaxation technique.

Independent variables, the relaxation technique and locus of control orientation as measured by Rotter's I-E Scale were tested for their possible relationship to the dependent variables of blood pressure, dopamine-beta-hydroxylase (DBH) and

state anxiety as measured on Spielberger's STAI A-State scale. Analyses of variance, Pearson product moment correlations and t-tests were used to analyze the data.

Clinic systolic blood pressure measurements revealed a significant decrease of 7.5 mmHg for the relaxation group compared to a decrease of 1.7 mmHg for the control group. Clinic diastolic blood pressure measurements revealed a non-significant decrease of 3.8 mmHg for the relaxation group compared to 0.6 mmHg for the control group. Home blood pressure measurements revealed a nonsignificant decrease of 6.6 mmHg systolic and 4.9 mmHg diastolic for the relaxation group compared to an increase of 0.6 mmHg systolic and 2.1 mmHg diastolic for the control group. Home blood pressure measurements were significantly lower than clinic blood pressure measurements. Changes in clinic blood pressure were not related to changes in home blood pressure measurements. DBH levels did not differ between groups or change over time. I-E Scale scores were not related to blood pressure difference scores for the relaxation group. STAI A-State scores did not differ between groups or change over time.

Conclusions drawn from the present study were (1) the relaxation technique is useful in reducing clinic systolic blood pressure and as such has implications for use as a nursing intervention in the treatment plan for hypertensive individuals, (2) DBH levels, possibly reflecting sympathetic nervous system activity are unaffected by six-weeks use of the relaxation technique, (3) anxiety, as measured by the STAI A-State scale is unaffected by six-weeks use of the relaxation technique, and (4) locus of control orientation, as measured by Rotter's I-E Scale does not accurately predict which individuals would most benefit from the use of the relaxation technique. Additional conclusions were drawn. First, blood pressure measurements recorded in the clinic situation are higher than, and do not accurately represent, home blood pressure measurements. Second, externally oriented individuals are more compliant than internally oriented individuals in terms of following this type of research protocol. Recommendations for further study were suggested.